भारतीय मानक

Indian Standard

IS 12488 : 2023

ढुलाई रस्सी कैपल्स — विशिष्टि

(पहला पुनरीक्षण)

Haulage Rope Cappels — Specification

(First Revision)

ICS 73.100.40

© BIS 2023

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

June 2023 **Price Group 7**

Mining Techniques and Equipment Sectional Committee, MED 08

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Mining Techniques and Equipment Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published in 1988. This standard is being revised again to keep pace with the latest technological developments and international practices. Also, in this revision, the standard has been brought into latest style and format of Indian Standards, and references to Indian Standards, wherever applicable have been upadated. BIS certfication marking clause has been modified to align with the revised Bureau of Indian Standard Act, 2016.

The composition of the Committee responsible for the formulation of this standard is listed in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

HAULAGE ROPE CAPPELS — SPECIFICATION

(First Revision)

1 SCOPE

Lays down the requirements for rope cappels for use with haulage ropes to attach the haulage rope with tub/mine car or a set of mine tubs or mine cars or any other means of conveyance.

2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. In case the standards are to be referred in this clause they are to be listed as follows:

IS No.	*Title*
IS 25 : 1979	Specification for antifriction bearing alloys (*third revision*)
IS 209 : 1992	Zinc ingot — Specification (*fourth revision*)
IS 1570 (Part 2/Sec 1) : 1979	Schedules for wrought steels: Part 2 Carbon steels (Unalloyed Steels): Sec 1, Wrought products (other than wires) with specified chemical composition and related properties (*first revision*)
IS 1835 : 1976	Specification for round steel wire for ropes (*third revision*)
IS 3937	Recommendations for socketing of wire ropes:
(Part 1) : 1974	Socketing with zinc (*first revision*);
(Part 2) : 1974	Socketing with white metal (*first revision*)
IS 4367 : 1991	Alloy steel forgings for general industrial use — Specification (*first revision*)
IS 4432 : 1988	Specification for case hardening steels (*first revision*)
IS 15838 (Part 10) : 2008	Mining — Glossary of terms

3 TERMINOLOGY

For the purpose of this standard, following definitions shall apply:

3.1 Basket — The tapered portion of the socket.

3.2 Cappel — *see* **2.23** of IS 15838 (Part 10).

3.3 Capping — *see* **2.24** of IS 15838 (Part 10).

3.4 Seizing — The wire wrapped around a rope to hold its wires in position when cutting and/or capping.

3.5 Socket — The metallic body of the capping.

4 TYPES

a) Type A — White metal conical cappel with open type or closed type socket; and
b) Type B — Conical cappel with zinc cone and tail strand.

5 DIMENSIONS

5.1 Type A Cappels

5.1.1 *Open Type Socket*

As specified in Table 1.

5.1.2 *Closed Type Socket*

As specified in Table 2.

5.1.3 *Pins for Open Type Socket*

As specified in Table 3.

5.2 Type B Cappels

5.2.1 *Sockets*

As specified in Table 4.

5.2.2 *Pins and Nuts for Sockets*

As specified in Table 5.

5.2.3 *Zinc Cone and Tail Strand*

As specified in Table 6.

5.3 Links and Closed Shackel

As specified in Table 7.

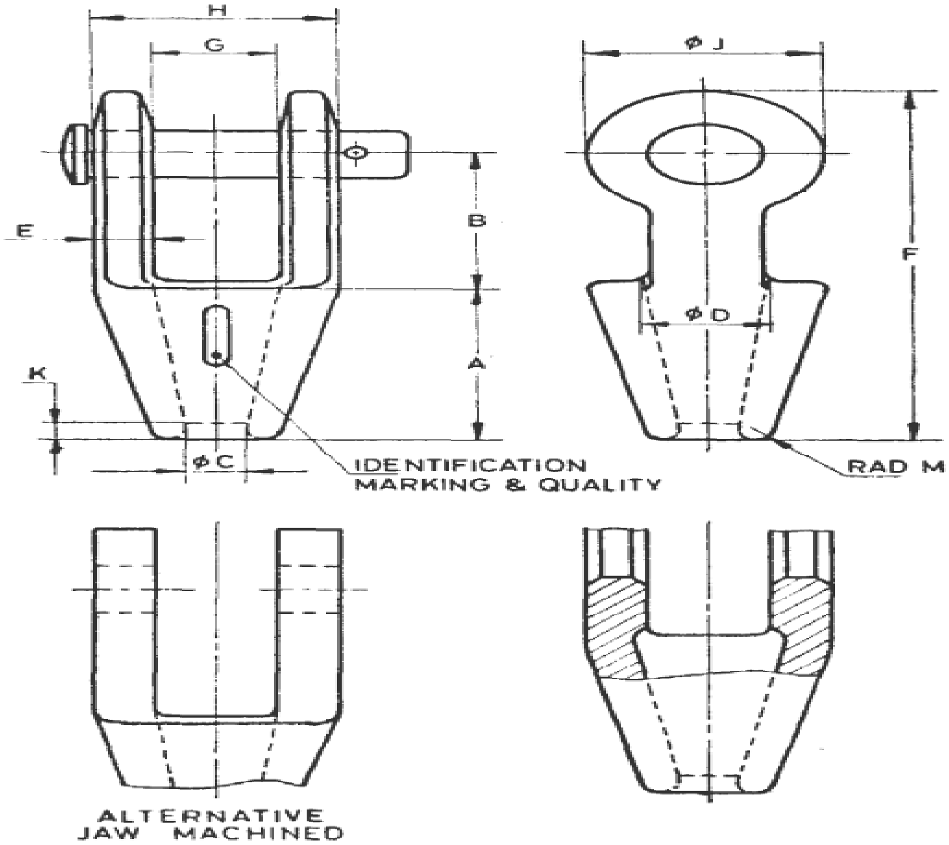
5.4 Tolerances

5.4.1 The diameter of the bore ***D*** and ***E*** in Table 4 shall be checked by a taper plug gauge of suitable size. When the gauge is in position, it shall not be possible to insert a 0.25 mm diameter wire feeler gauge between the taper plug gauge and the bore. This shall apply to either end of the bore.

Table 1 Dimensions for Open Socket for Type A Cappel

(*Clause* 5.1.1)

All dimensions in millimetres

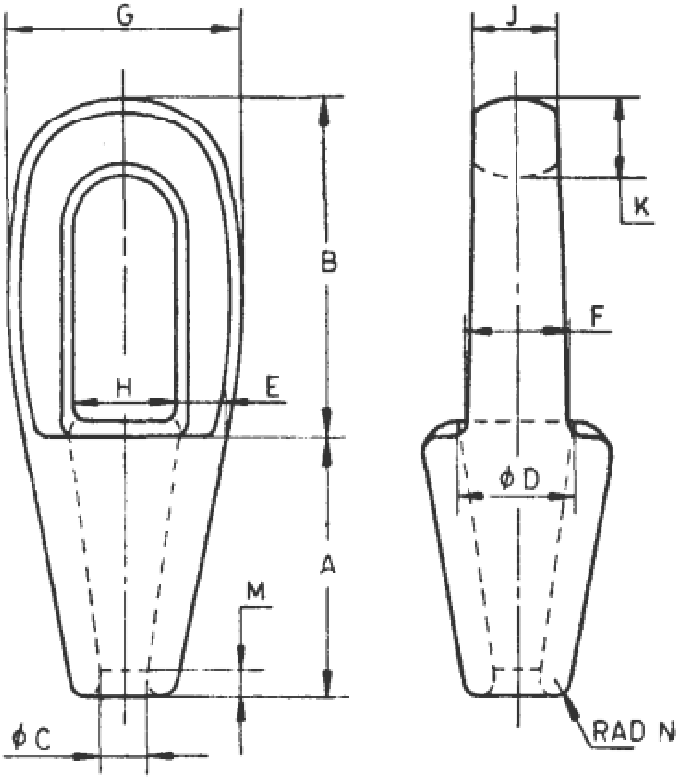


Sl No.	Diameter of Rope	A	B	C	D	E	F	G	H	J	K	M
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	16	69.8	63.5	18.3	31.8	11.1	158.8	31.8	58.7	50.8	7.9	1.6
ii)	19	76.2	66.7	21.4	38.1	12.7	174.6	38.1	69.9	63.3	9.5	2.0
iii)	22	85.7	76.2	25.4	44.5	14.3	196.9	42.9	77.8	69.9	11.1	2.4
iv)	25.4	104.8	88.9	28.6	50.8	17.5	236.5	47.6	88.9	85.7	12.7	2.4
v)	29	114.3	101.6	31.8	57.2	19.0	261.9	50.8	93.7	92.0	13.2	2.8
vi)	32	133.4	111.1	34.9	63.5	23.8	296.9	54.0	111.1	104.8	15.9	3.2

Table 2 Dimensions for Closed Type Sockets of Type A Cappels

(*Clause* 5.1.2)

All dimensions in millimetres

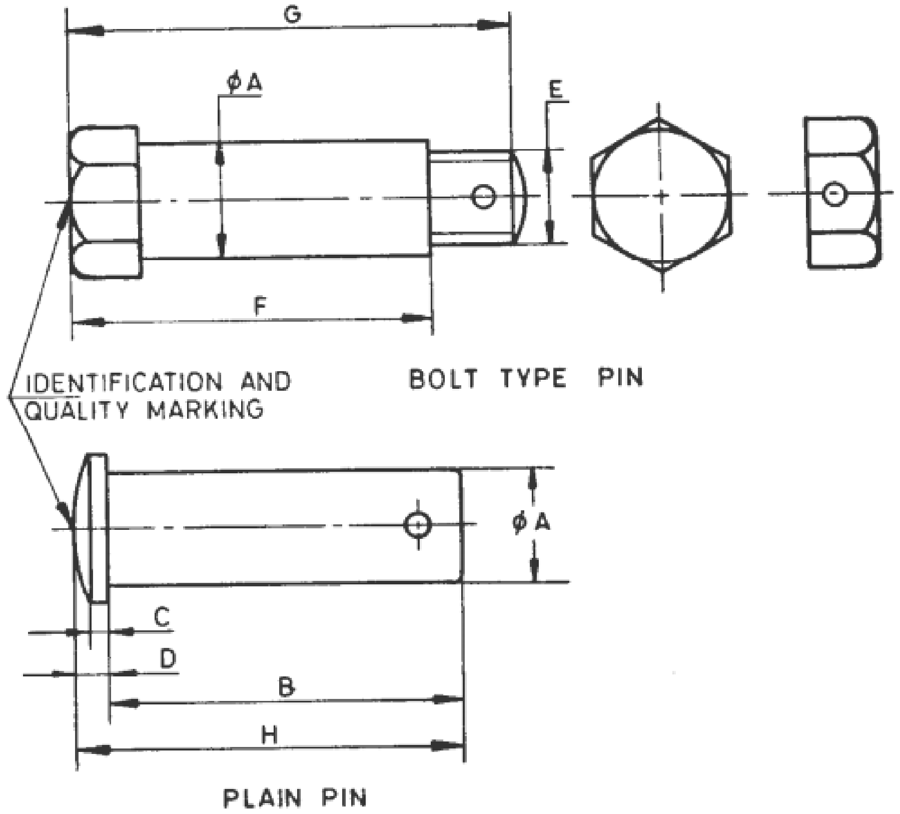


Sl No.	Diameter of Rope	A	B	C	D	E	F	G	H	J	K	L	M
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
i)	16	69.8	88.9	18.3	31.8	11.1	27.0	63.5	31.8	20.6	19.0	7.9	1.6
ii)	19	76.2	101.6	21.4	38.1	12.7	33.3	74.7	38.1	25.4	23.8	9.5	2.0
iii)	22	85.7	114.3	25.4	44.5	14.3	39.7	84.1	44.5	28.6	25.4	11.1	2.4
iv)	25.4	104.8	130.2	28.6	50.8	17.5	46.0	100.0	50.4	35.0	28.6	12.7	2.4
v)	29	114.3	142.9	31.8	57.0	19.0	50.8	114.3	57.0	38.1	31.8	13.2	2.8
vi)	32	133.0	152.4	35.0	63.5	23.8	60.3	123.9	63.5	41.3	15.9	15.9	3.2

Table 3 Dimensions for Pins for Open Type Sockets of Type A Cappels

(*Clause* 5.1.3)

All dimensions in millimetres

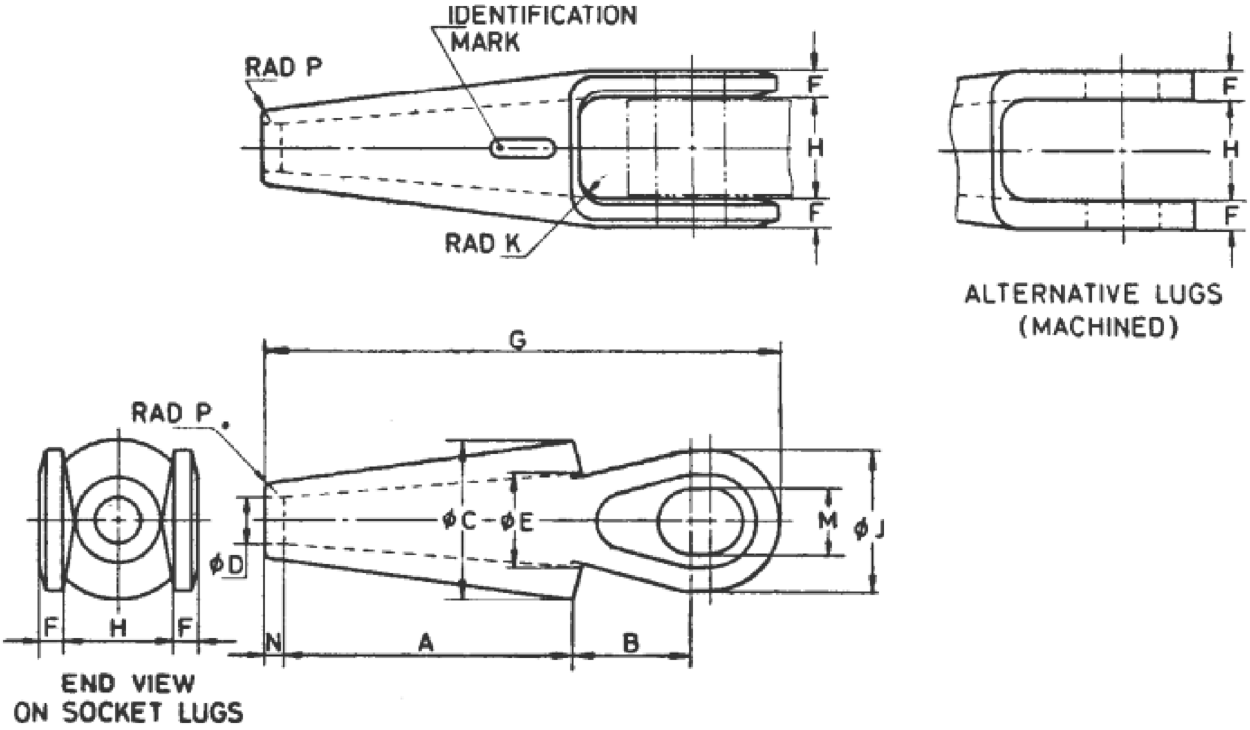


Sl No. (1)	Diameter of Rope (2)	A (3)	B (4)	C (5)	D (6)	E (7)	F (8)	G (9)	H (10)
i)	16	23.8	74.6	4.0	6.3	15.9	60.3	81.0	81.0
ii)	19	28.6	85.8	4.8	7.1	18.0	71.4	92.9	92.9
iii)	22	31.8	95.3	4.8	8.0	22.2	81.0	109.5	103.2
iv)	25.4	38.1	109.5	5.6	9.5	28.6	90.5	127.8	118.1
v)	29	41.3	114.3	6.4	11.1	31.8	95.3	136.5	125.4
vi)	32	47.6	136.5	8.0	12.7	38.1	112.7	162.0	149.2

Table 4 Dimensions for Sockets of Type B Cappels

(*Clauses* 5.2.1 *and* 5.4.2)

All dimensions in millimeters

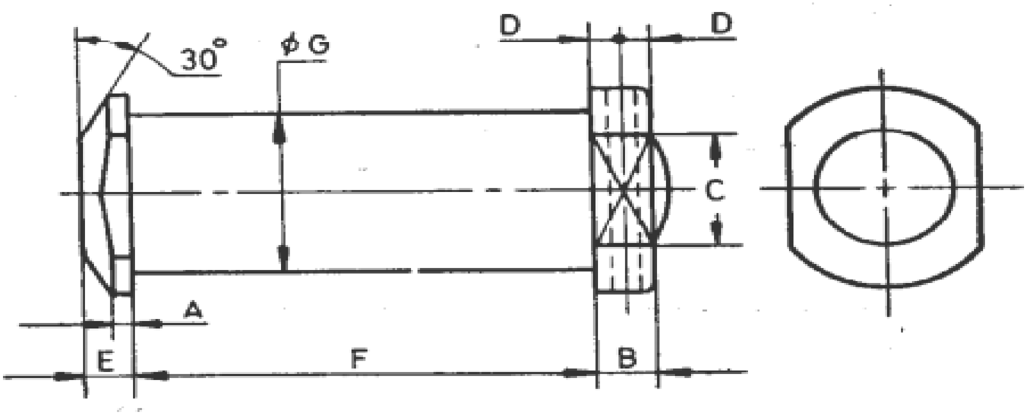


Sl No.	Diameter of Rope	A	B	C	D	E	F	G	H	J	K	L	N	P
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
i)	16	133.4	63.6	69.9	20.6	44.5	12.7	239.7	49.2	63.5	19.0	31.8	9.5	3.2
ii)	19	155.6	69.9	82.6	23.8	50.8	15.9	274.6	55.6	69.9	19.0	34.9	11.1	3.2
iii)	22	177.8	79.4	92.0	27.2	57.2	17.5	312.7	61.9	79.4	22.2	41.3	12.7	3.2
iv)	25.4	196.9	88.9	101.6	30.2	63.5	19.0	346.0	68.3	88.9	25.4	44.5	12.7	3.2
v)	29	215.9	101.6	114.3	33.3	69.9	22.2	387.4	76.0	101.6	25.4	50.8	15.9	4.8
vi)	32	238.1	108.0	123.8	36.5	76.2	23.8	409.1	82.6	108.0	31.8	54.0	15.9	4.8

Table 5 Dimensions for Pins and Nuts for Type B Cappels

(*Clauses* 5.2.2 *and* 5.4.2)

All dimensions in millimetres

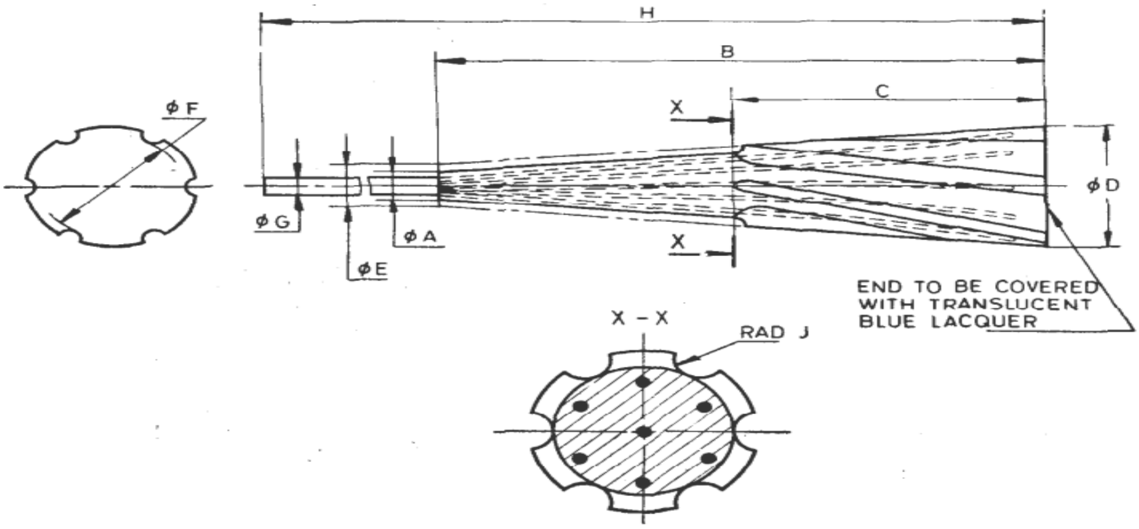


Sl No.	Diameter of Rope	A	B	C	D	E	F	G
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	16	3.2	9.5	22.2	4.8	7.9	77.0	31.8
ii)	19	4.8	9.5	28.6	4.8	7.9	89.7	34.9
iii)	22	4.8	12.7	34.9	6.4	9.5	100.0	38.1
iv)	25.4	4.8	12.7	34.9	6.4	9.5	109.5	44.5
v)	29	4.8	15.9	38.1	7.9	11.1	125.4	50.8
vi)	32	4.8	15.9	41.2	7.9	12.7	134.1	54.0

Table 6 Dimensions for Zinc Cone and Tail Strand Units of Type B Cappels

(*Clause* 5.2.3)

All dimensions in millimetres

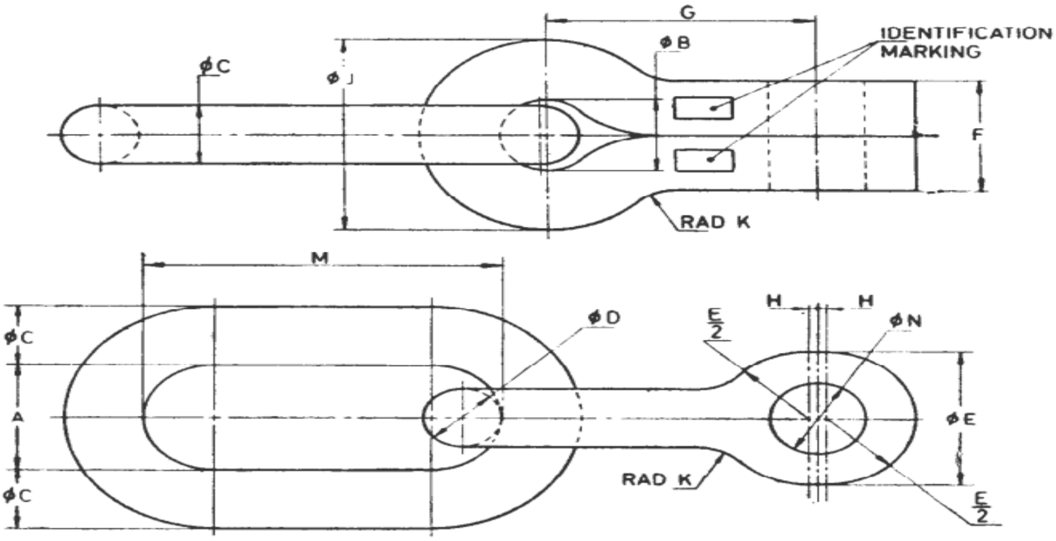


Sl No.	Diameter of Rope	A	B	C	D	E	F	G	H	J
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
i)	16	9.5	142.9	73.0	40.5	14.7	35.3	6.4	685.8	3.2
ii)	19	9.5	168.3	85.7	45.2	15.9	38.9	7.1	685.8	3.6
iii)	22	11.1	190.5	98.4	50.8	18.7	43.2	8.3	711.2	4.4
iv)	25.4	12.7	209.6	104.8	56.2	21.0	48.8	9.5	812.8	4.8
v)	29	12.7	228.6	117.5	61.1	22.2	51.6	10.3	914.4	5.6
vi)	32	14.3	254.0	130.2	67.5	24.6	57.2	11.5	1016.6	6.0

Table 7 Dimensions for Link and Closed Shackle

(*Clause* 5.3)

All dimensions in millimetres



Sl No.	Diameter of Rope	A	B	C	D	E	F	G	H	J	K	L	N	Working load kN
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
i)	16	44.5	27.0	22.2	22.2	63.5	46.0	88.9	1.6	71.5	15.9	120.7	31.8	25
ii)	19	50.8	33.3	28.6	28.5	69.9	52.4	95.2	3.2	90.5	19.1	127.0	34.9	36
iii)	22	50.8	36.5	31.8	31.8	79.4	58.7	101.6	3.2	100.0	22.2	133.4	41.3	49
iv)	25.4	50.8	36.5	31.8	34.9	88.9	63.5	108.0	3.2	100.0	22.2	136.5	44.5	64
v)	29	57.2	42.9	38.1	38.1	101.6	71.4	127.0	3.2	119.1	25.4	152.4	50.8	80
vi)	32	57.2	46.0	41.3	41.3	108.0	77.8	127.0	3.2	119.1	25.4	161.9	54.0	100

5.4.2 Following tolerances shall apply to the pins, pin holes and lug dimensions:

Socket Size Range	*Dimension*	*Tolerance*
Full range	Width over lugs	+ 100 – 0.25
Full range	Thickness of lugs, *F* (*see* Table 4)	+ 0.50 – 0.25
25 mm and below	Diameter of pin hole, *M* (*see* Table 4)	+ 1.2 – 0
Above 25 mm		+ 1.5 – 0
Full range	Length over pin shoulders, *F* (*see* Table 5)	+ 0.25 – 0.25
32 mm and below	Diameter of pin, G (*see* Table 5)	+ 0.80 – 0.25

6 MATERIALS

6.1 Sockets, pins, link and shackle units shall be manufactured from steel conforming to 11Mn2 or 20Ni55Cr50Mo20 of IS 4432 or 20Mn2 of IS 4367.

6.2 White metal used for capping shall conform to Grade 5 of IS 25.

6.3 Zinc used in case of Type B cappel shall conform to Grade Zn98 of IS 209.

6.4 Tail strand of Type B cappel shall be made from galvanized steel wire strand of 6/1 construction. The wires used in the construction of strand shall be of 1 230 or 1 420 tensile designation the wire shall have the tensile strength between 1 428 MPa and 1 530 MPa having Type B galvanizing according to IS 1835.

6.5 Nuts and washers shall be manufactured from steel conforming to IS 1570 (Part 2/Sec 1).

7 DESIGNATION

A haulage rope cappel of Type A with open type socket suitable for wire rope of 16 mm size and conforming to this standard shall be designated as:

Haulage Rope Cappel AO 16 IS 12488

NOTE — Letters ‘O’ and ‘C’ shall be used to designate open type and closed type socket respectively in case of Type A rope cappel only.

8 GENERAL REQUIREMENTS

8.1 Factor of Safety

The rope cappels shall have a factor of safety of not less than 8 with respect to safe working load for which the cappel is designed.

8.2 Capping of sockets shall be done in accordance with IS 3937 (Part 2) in case of Type A cappels and in accordance with IS 3937 (Part 1) in case of cappels of Type B. The fitting of terminal wire rope sockets by the cone and tail method shall be done in accordance with IS 12489.

9 MANUFACTURING REQUIREMENTS

9.1 Sockets and pins shall be manufactured by hot forging and shall be machined subsequently.

9.2 Sockets shall show good workmanship and shall be free from any defects. Flashes and fins shall be dressed to level surfaces.

9.3 Taper in the socket shall be machined uniformly and smoothly, the small end of the basket shall terminate in a short parallel length with radius machined at the orifice.

9.4 Outside and inside faces of the lugs shall be machined.

9.5 Pin holes shall be drilled or otherwise machined from solid in one operation and at one setting. The axis of pin when fitted shall be at right angles to the axis of the socket basket. The surface of the hole and the pin shall be smooth and well finished.

9.6 For sockets where gas cutting is used to assist in rough shaping, adequate excess material shall be left after gas cutting for removal, by machining or grinding, of surface defects, effects of gas cutting, etc.

9.7 The links shall be drop forged. Alternatively, the links may be welded by the electric pressure-butt, electric flash-butt or atomic hydrogen welding.

9.7.1 The weld shall be smoothly finished all round, care being taken to avoid unsoundness and to ensure adequate penetration and fusion throughout the section.

10 HEAT TREATMENT

After the forgings and gas cuttings, all the components of the haulage rope cappel except zinc cone and split pin, shall be suitably hardened and tempered.

10.1 The hardness of the components after heat treatment shall be as follows:

Material of Component	*Hardness Value HV*
11 Mn2	190 to 220
20 Mn2	220 to 250
20 Ni55Cr50Mo20	250 to 280

10.1.1 The recommended hardening and tempering temperatures and quenching media are given below:

Steel Designation	*Hardening Temperature °C*	*Tempering Temperature °C*	*Quenching Media*
11Mn2	870 – 910	550 – 660	Water or oil
20 Mn2	860 – 900	550 – 660	Water or oil
20 Ni55 Cr50 Mo20	820 – 850	—	Water

11 TESTING

11.1 Each finished unit shall be proof loaded to a load of not less than three times the safe working load for which the unit is designed. The unit shall satisfactorily withstand such proof load without any deformation.

11.2 After conducting the proof load test, the sockets, pins and connecting links shall be magnetically or ultrasonically or by both the methods where the purchaser so desires, tested for cracks and flaws, etc.

11.3 Any component which does not conform to **11.1** and **11.2** shall not be used and shall be destroyed effectively.

12 MARKING

Each component shall be legibly and permanently stamped on unwearable portion with the following:

a) Manufacturer’s name or his recognized identification mark;
b) Safe working load;
c) Nominal size of rope with which the cappel is to be used; and
d) Abbreviation of the material ‘M’ for 11Mn2 and 20Mn2 and ‘N’ for 20Ni55Cr50Mo20.

12.1 BIS Certification Marking

The Rope cappels may also be marked with Standard Mark.

12.1.1 The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Mining Techniques and Equipment Sectional Committee, MED 08

Organization	*Representative(s)*
Directorate General of Mines Safety, Dhanbad	Shri Saifullah Ansari (***Chairperson***) Shri M Arumugam (*Alternate*)
Andhra Pradesh Heavy Machinery and Engineering Limited, Vijayawada	Shri T V Ramana
BEML Limited, Bengaluru	Shri V. R. S. Prasad Rao Shri H. G. Suresh (*Alternate*)
Bharat Coking Coal Limited, Dhanbad	Shri P. K. Sinha
CSIR - Central Institute for Mining and Fuel Research, Dhanbad	Dr Manoj Kumar Singh Shri Surajit Dey (*Alternate*)
Caterpillar India Private Limited, Chennai	Shri K. Reji Jose
Eastern Coalfields Limited, Dishergarh	Dr Manas Kumar
Eimco Elecon (India) Limited, Vallabh Vidyanagar	Shri Bhavin K. Bhatt
Hindustan Zinc Limited, Kolkata	Shri B. V. Rao
Indian Institute of Technology (ISM), Dhanbad	Shri L. A. Kumaraswamidhas
John Deere India Private Limited, Mumbai	Shri Karthik Kaliappan
Manganese Ore Limited, Nagpur	Shri Atul Sharma Shri Rakesh Ku Verma (*Alternate* I) Shri Ashwini Baghele (*Alternate* II)
Nanda Millar Company, Kolkata	Shri J. P. Goenka Shri Madhur Goenka (*Alternate*)
National Mineral Development Corporation, Hyderabad	Shri D. Rajasekaran
South Eastern Coalfields Limited, Bilaspur	Shri Kapil K. Rai Shri D. Bhattacharjee (*Alternate*)
Tata Steel Limited, Dhanbad	Shri Abinash Jha Shri Soumendhu Manjhi (*Alternate*)
BIS Directorate General	Shri Rajneesh Khosla, Scientist 'F'/Senior Director and Head (Mechanical Engineering) [Representing Director General (*Ex-officio*)]

Member Secretary
Shri Sandeep Keshav
Scientist 'C'/Deputy Director
(Mechanical Engineering), BIS

This Page has been Intentionally left blank

This Page has been Intentionally left blank

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Head (Publication & Sales), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.

This Indian Standard has been developed from Doc No. : MED 08 (19667)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices: *Telephones*

Central : 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002 — 2323 7617

Eastern : 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091 — 2367 0012, 2320 9474

Northern : Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019 — 265 9930

Southern : C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113 — 2254 1442, 2254 1216

Western : Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093 — 2821 8093

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. CHANDIGARH. CHENNAI. COIMBATORE. DEHRADUN. DELHI. FARIDABAD. GHAZIABAD. GUWAHATI. HIMACHAL PRADESH. HUBLI. HYDERABAD. JAIPUR. JAMMU & KASHMIR. JAMSHEDPUR. KOCHI. KOLKATA. LUCKNOW. MADURAI. MUMBAI. NAGPUR. NOIDA. PANIPAT. PATNA. PUNE. RAIPUR. RAJKOT. SURAT. VISAKHAPATNAM.

Published by BIS, New Delhi